

Gender Bias in the Evaluation and Management of Acute Nontraumatic Chest Pain

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ABSTRACT: **BACKGROUND:** Prior studies suggest a gender-based difference in the management of myocardial ischemia in nonacute settings. We examined whether there was a gender difference in the emergency department evaluation and management of patients with acute chest pain. **METHODS:** A record review from 10 St. Louis metropolitan emergency departments was done on all patients over 35 years old who presented with acute nonpleuritic, nontraumatic chest pain. We reviewed for the presence of cardiac risk factors, prior cardiac disease, time to physician evaluation, and time to initial electrocardiogram. In the patient subgroup admitted from the emergency department with a diagnosis of myocardial infarction or unstable angina, disposition was noted. **RESULTS:** Women waited longer than men for an initial physician evaluation and an initial electrocardiogram. In the patient subgroup with acute myocardial ischemia, a smaller percentage of women than men (56.0% vs 82.8%) were admitted to an intensive care unit. **CONCLUSION:** In patients with acute nonpleuritic, nontraumatic chest pain, women were evaluated and managed less aggressively than men.

KEY WORDS: Ischemic Heart Disease, Gender Differences, Acute Disease

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Several studies have suggested a difference between men and women in the utilization of health care resources regarding the evaluation and management of cardiovascular disease. Kennedy et al found a rate of coronary arteriography 3.4 times greater in men than in women (1). A similar study by Gillum found an age-adjusted sex ratio (male/female) of 2.5 for rate of cardiac arteriography and 4.1 for coronary artery bypass surgery (2).

This difference in utilization rates, however, appears not to be entirely due to differing rates of ischemic myocardial disease. An epidemiological study by Elveback et al identified a male-to-female ratio of 2:1 for the age-adjusted rates of coronary heart disease (3), an incidence ratio less than the one suggested by utilization rates. The above studies fail to explain the relative underutilization of health care resources for women with ischemic myocardial disease.

In a study by Tobin et al, cardiac nuclear scans were abnormal in 31% of the women and 64% of the men studied. However, only 4% of the women with abnormal scans were subsequently referred for cardiac catheterization vs 40% of the men. A detailed examination of the exact abnormalities identified in the nuclear studies could not justify these differing rates (4). A study by Khan et al reasoned that the higher age-adjusted operative mortality among women vs men undergoing coronary bypass surgery could be explained by the finding that women are referred for surgery later in the course of their disease (5). Steingart et al reviewed the medical records of post-myocardial infarction (MI) patients with a left ventricular ejection fraction less than or equal to 40%. The men and women studied were equally likely to have had pre-MI angina, but despite the greater pre-MI disability of the women, men were twice as likely to undergo cardiac catheterization (6). These gender-related differences in the management of patients with coronary artery disease were made even more significant by a recent study that determined women have a higher mortality than men after suffering an acute myocardial infarction (7).

In light of the above studies suggesting a gender difference in the management of patients with coronary artery disease, we attempted to determine if there is also a gender-related difference in the evaluation and management of patients with acute nontraumatic, nonpleuritic chest pain who present to the emergency department (ED).

The development of time-dependent modalities of treatment for myocardial ischemia has made rapidity of evaluation essential. The time it takes for a patient with signs and symptoms of acute myocardial ischemia to be evaluated is a key component where the potential for gender bias may come into play. We examined the time to evaluation for men vs women who presented to the ED with a chief complaint of nontraumatic chest pain to determine if there was a significant gender-related difference in this variable. Differences in aggressiveness of management in the ED setting were gauged by looking at the final disposition of patients admitted with a diagnosis of acute myocardial ischemia.

We found that men with an acute onset of nontraumatic, nonpleuritic chest pain were both evaluated earlier and managed more aggressively than women. Our study suggests that gender bias exists in the evaluation and management of ischemic myocardial disease in the ED setting.

METHODS

Four hundred forty-five patients over 35 years of age who presented with nontraumatic, nonpleuritic chest pain to any of ten participating St. Louis metropolitan area EDs from August 10 to August 24, 1989, were evaluated. To identify relevant charts, the participating EDs flagged the medical records of all patients presenting with nontraumatic chest pain. A designated study nurse reviewed the entry logbook at each center to identify charts that inadvertently may not have been flagged. Inclusion criteria were a) chest pain as a chief complaint, b) patient age > 35 , and c) new onset of chest pain within the last 24 hours. Exclusion criteria were a) primary or associated trauma, b) chest pain specifically characterized as stabbing, sharp, or burning, and c) pain that occurred only with movement. The 96 emergency physicians who were involved in the evaluation of these patients were numerically coded. A standardized chart audit was performed by blinded personnel. Patient age and gender, time of first contact with a physician, time to first electrocardiogram (ECG), associated symptoms, presence or absence of cardiac risk factors, presence or absence of previous cardiac disease, final ED diagnosis, and patient disposition upon discharge from the ED were recorded. The times to first contact with a physician and first ECG were categorized into segmental increments in minutes: 0–10, 11–20, 21–30, 31–40, 41–60, and over 60. Charts with missing data were excluded from statistical analysis only for the categorical variable in which the chart was deficient, occasionally resulting in a different total number (n) for each variable evaluated.

We then compared the above variables between men and women using the Statistical Package for the Social Sciences (SPSS Inc., Chicago). The procedure MANOVA was used for multivariate, univariate, and covariate analysis. Chi-square analysis with the CROSSTABS procedure was used for univariate comparisons of dichotomous variables. A Student's t-test was used to compare mean age.

RESULTS

A total of 96 physicians saw 199 men and 246 women that fit our criteria over the study period. The maximum number of patients seen by any single

Table 1. A Comparison of Selected Variables between Women and Men in the Study Group

	Women	Men
n	246 (55%)	199 (45%)
Mean Age (range)	67* (35-90)	62 (35-90)
Prior Cardiovascular Disease	64%	59%
Presence of Cardiac Risk Factors	86%	80%
Myocardial Infarction	5%**	13%
Unstable Angina	27%	26%
Acute Myocardial Ischemia	32%	39%

*p<0.001.

**p<0.05.

physician was 22 (4.9% of 445), with the mean number being 4.6 ($s=4.0$). Women were on average 5 years older than the men ($p<0.001$). The percentage of women with a prior history of cardiac disease or with known cardiac risk factors was comparable to men. The percentage of women in the group receiving an ED diagnosis of unstable angina was nearly identical to that of men. The diagnosis of myocardial infarction (MI), however, was made less often in women ($p<0.05$). There was no statistically significant difference in the percentage of women vs men with an ED diagnosis of acute myocardial ischemia, ie, either unstable angina or MI (Table 1).

Among all patients in the study group, a larger percentage of the men were seen within 30 minutes than were women (91.7% vs 82.6%, $p<0.05$). When each physician was given equal weight in the analysis and adjustment was made for age, the significance of the trend for greater times to physician evaluation for women became even more significant ($p<0.02$, Table 2).

A larger percentage of the men than women had an initial ECG within 30 minutes (83.8% vs 74.2%, $p<0.02$). When each physician was given equal weight in the analysis and adjustment was made for age, presence of cardiac risk factors, and a history of prior cardiac disease, the trend toward greater times to initial ECG for women vs men was statistically highly significant ($p<0.01$, Table 2).

In the patient subgroup with an ED diagnosis of acute myocardial ischemia, men and women had a differing prevalence of associated signs and symptoms (Table 3). Women in this subgroup tended to present with diaphoresis less often and shortness of breath or nausea/vomiting more often than did men. It was further noted in this diagnostic subgroup that men were admitted to an intensive care unit more often than women ($p<.05$). The remainder of patients were admitted to a telemetry service except for one patient (a woman) who was admitted to a general internal medicine floor. The difference in ICU admission

Table 2. Times to Initial Physician Evaluation and Initial Electrocardiogram

	Women	Men
Minutes to physician evaluation*		
0-10	54.4%	60.4%
11-20	18.8%	22.9%
21-30	9.4%	8.3%
31-40	4.0%	2.1%
41-60	6.7%	2.1%
61+	6.7%	4.2%
Total	100%	100%
Minutes to initial electrocardiogram**		
0-10	32.5%	41.9%
11-20	25.8%	22.8%
21-30	14.1%	19.1%
31-40	12.9%	6.6%
41-60	6.7%	2.2%
61+	8.0%	7.4%
Total	100%	100%

* $p=0.0184$ for the trend after physician weighing and adjustment for age.

** $p=0.0086$ for the trend after physician weighing and adjustment for age, presence of cardiac risk factors, and a history of prior cardiac disease.

rates was even greater when each physician was given equal weight in the analysis (Table 3).

DISCUSSION

Our study has several limitations. First, inclusion in the study relied in part upon the flagging of charts by ED personnel at the time the patient presented. Although the patient logs were also reviewed in an attempt to capture all eligible patients, it is possible some cases slipped by. Also, the emergency physician's gender was not specified so we cannot determine if a physician's bias is affected by his or her own gender. Finally, the method of data collection would tend to make the study more likely to detect a gender distinction than to exclude one. These limitations leave a small possibility that the way the data was collected rather than a true gender distinction is responsible for the differences found.

A possible explanation for a difference in the rapidity with which men as opposed to women are evaluated for chest pain may have to do with the initial presentation rather than a true gender bias. In the subgroup of patients with a final ED diagnosis of acute myocardial ischemia, we found diaphoresis to be much less common among women than men, with the reverse being the case for shortness of breath and nausea and vomiting. Diaphoresis is often consid-

Table 3. A Comparison of Selected Variables between Women and Men with an Emergency Department Diagnosis of Either Myocardial Infarction or Unstable Angina

	Women	Men
Chief sign or symptom was		
diaphoresis	2.9%*	32.4%
nausea/vomiting	29.4%	14.7%
shortness of breath	44.1%	23.5%
none	20.6%	5.9%
other	2.9%	23.5%
Admitted to an intensive care unit after physician weighing	56.0%** 53.9%**	82.8% 95.2%

*p<0.01.

**p<0.05.

ered an ominous finding and a key associated sign in identifying patients with acute myocardial ischemia (8,9), whereas nausea and vomiting may initially misdirect triage considerations along a different and less urgent pathway. One possible explanation for the difference in associated signs and symptoms between men and women is a gender-related difference in the autonomic nervous system's response to myocardial ischemia. Our literature review did not find any previous reports of gender-specific differences in the frequency of associated signs or symptoms in acute myocardial ischemia. Another study is currently in progress that will evaluate specific hemodynamic parameters and note the presence or absence of diabetes mellitus (which could cause autonomic dysfunction) to further investigate this phenomenon.

The second and perhaps more likely explanation may be medical bias. In spite of recent studies evaluating the prevention and treatment of coronary vascular disease in women (6,10), heart attacks may still be considered a disease of men or more serious in men (11). Such medical bias may be perpetuated in at least two forms: *availability bias* and *overgeneralization bias* (12,13). Until recently, much of the research on cardiac disease has looked only at male subjects (15). Thus, availability bias becomes perpetuated because physicians simply do not have available to them nearly as many studies on acute myocardial ischemia in women as in men. Furthermore, the conclusions of these male-only or male-preponderant studies encourage overgeneralization bias by assuming that women with myocardial ischemia present with signs and symptoms identical to men.

In conclusion, we have identified what may be a gender bias in the ED evaluation and management of acute myocardial ischemia. It is possible that the source of this bias comes from the relative lack of sexually balanced research on ischemic myocardial disease. Until such studies are performed and their

results disseminated, physicians may unknowingly exercise gender bias when evaluating patients with acute chest pain.

REFERENCES

1. Kennedy RH, Kennedy MA, Frye RL, et al. Cardiac-catheterization and cardiac-surgical facilities: use, trends, and future requirements. *N Engl J Med* 1982;307:986-93.
2. Gillum RF. Coronary artery bypass surgery and coronary angiography in the United States, 1979-1983. *Am Heart J* 1987;113:1255-60.
3. Elveback LR, Connolly DC, Melton LJ. Coronary heart disease in residents of Rochester, Minnesota. VII. Incidence, 1950 through 1982. *Mayo Clinic Proc* 1986;61:896-900.
4. Tobin JN, Wassertheil-Smoller S, Wexler JP, et al. Sex bias in considering coronary bypass surgery. *Ann Intern Med* 1987;107:19-25.
5. Khan SS, Nessim S, Gray R, Czer LS, Chaux A, Matloff J. Increased mortality of women in coronary artery bypass surgery: evidence for referral bias. *Ann Int Med* 1990;112:561-7.
6. Steingart RM, Packer M, Hamm P, et al. Sex differences in the management of coronary artery disease. *N Engl J Med* 1991;325:226-30.
7. Greenland P, Reicher-Reiss H, Goldbourt U, Behar S. In-hospital and 1-year mortality in 1,524 women after myocardial infarction. Comparison with 4,315 men. *Circulation* 1991;83:484-91.
8. Hargarten KM, Aprahamian C, Stueven H, Olson DW, Aufderheide TP, Mateer JR. Limitations of prehospital predictors of acute myocardial infarction and unstable angina. *Ann Emerg Med* 1987;16:1325-9.
9. Gibler WB, Blanton J. Early identification of patients with acute myocardial infarction. *Compr Ther* 1988;14(8):41-4.
10. Manson JE, Stampfer MJ, Colditz GA, et al. A prospective study of aspirin use and primary prevention of cardiovascular disease in women. *JAMA* 1991;266:521-7.
11. Genest JJ, McNamara JR, Salem DN, Schaefer EJ. Prevalence of risk factors in men with premature coronary artery disease. *Am J Cardiol* 1991;67:1185-9.
12. Tversky A, Kahneman D. Judgment under uncertainty: heuristics and biases. *Sci* 1974;185:1124-31.
13. Hohmann AA. Gender bias in psychotropic drug prescribing in primary care. *Med Care* 1989;27:478-90.
14. Wallis LA, Klass P. Toward improving women's health care. *J Am Med Wom Assoc* 1990;45:219-21.

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